Heart failure(HF) is a serious condition that develops when hearts don’t pump enough blood for the whole body’s needs. Heart failure is often caused by conditions that damage the heart like coronary heart disease, diabetes, high blood pressure.

As a serious condition requiring medical care and treatment, HF is affecting more than 6 million patients and their families in the United States, which brings a high public health cost and burden.[1]

A common complication of heart failure is renal dysfunction. Generally speaking, the reduced cardiac output and the consequently renal under-perfusion is the main pathophysiology cause of renal dysfunction because it leads to low renal blood flow and increased renal venous pressure.[1] Besides, neurohormonal activation(renin–angiotensin–aldosterone and  sympathetic nervous system), inflammatory activation and diuretic treatment are also mechanisms leading to renal dysfunction in patients with heart failure. [2]On the contrary, renal dysfunction may cause heart failure through mechanisms such as inflammatory activation and anemia (caused by a depression of renal erythropoietin production). [3]

The primary exposure, serum creatinine, is a chemical compound that can be filtered out of the blood by healthy kidneys, therefore serum creatinine could be used to calculate the glomerular filtration rate, which is an important indicator of kidney function. [4] Serum creatinine level is tested through venous blood, and has become routine clinical practice because of efficiency and easy procedures. Serum creatinine greater than its normal level (1.5) is an indicator of renal dysfunction.[6]

Based on this biological knowledge, we want to use serum creatinine as a biomarker to explore the relationship between renal dysfunction and mortality rates among patients with heart failure. Some previous studies are also related to this issue. Ahmad et al mainly identified potential risk factors for mortalities among HF patients and reported renal dysfunction (determined by serum creatinine levels) as a key factor contributing to increased risk of mortality. [6] Chicco et al. re-analyzed the dataset using machine learning methods and reported that the serum creatinine level is the most important predictor for these patients’ mortalities. [7] However, these studies concerned less on the modification of other biomarkers such as eject fraction and serum sodium, which are also related to heart failure through diverse mechanisms.[8] Therefore, we aimed to study potential effect modification by other biomarkers and fill the vacancy of existing studies.

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